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An ERTS-1 Project

INVESTIGATION OF THE DETECTION & MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA

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Progress Report
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(1)

Introduction

This is our progress report for the period of February 1 through March 31, 1973 for the Investigation of the Detection and Monitoring of Forest Insect Infestations in the Sierra Nevada Mountains of California through the use of ERTS 1 imagery supported by underflight photography.

This period has been devoted to office work since snow conditions prevented access to our target area. A paper, by the author, entitled "Application of ERTS 1 Imagery & Underflight Photography in the Detection and Monitoring of Insect Infestations in the Sierra Nevada Mountains of California," was prepared and presented at the Symposium on Significant Results Obtained from ERTS 1 on March 5 through 9, 1973 in New Carrollton, Maryland. Another paper by the author, entitled "Can A Consulting Forester Make Use of ERTS 1 and Underflight Support Photography in His Every Day Business," was prepared and submitted for publication in the "Consultant," the publication of the Association of Consulting Foresters. The author also presented an illustrated program on "The Contribution of ERTS 1, in the Field of Natural Resources Inventory and Management," to the Orinda Rotary Club on February 14, 1973.

Further work has been done with our ERTS 1 imagery for Yosemite for September 16, 1972.

ERTS 1 Imagery Enhancement

We have been cooperating with Ralph McFarland, Chief Photographer for the Pacific Southwest Forest & Range Experiement Station in enlarging false color images from ERTS 1 positive transparencies

(2)

supplied by NASA using 35 mm Kodochrome slides. This program is still in the development stage, but we feel that this technique has real promise in detecting different degrees of tree mortality from bark beetles and foliage damage from the needle miner.

Using ERTS 1 Imagery to Detect Insect Infestations

Since our last report we now feel quite certain that we can detect and map areas of tree mortality in three classes of light, medium, and heavy through the use of enlargements prepared from ERTS 1 positive color infrared transparencies processed by NASA by combining bands 4, 5, and 7 for the date of Sept. 16, 1972 for the Yosemite scene at a scale of 1 inch equals 1.5 nautical miles.

We have classified these damage areas on an arbitrary scale, visually as follows:

Classification	Color by Eye	From Munsell Book of Colors
Light Mortality	Blood Red	5R - 4 - 8
Medium Mortality	Chocolate Brown	10R - 5 - 4
Heavy Mortality	Moldy Yellow	5YR - 6 - 4

Our experience with visual interpretation of the original 9 x 9 color infrared positive transparencies for the orbit on Sept. 16, 1972 and with the color prints indicates that we can differentiate only two classes of tree mortality into damaged and no damage. On the basis of color classification these are:

Classification	Color by Eye	From Munsell Book of Color
No Damage	Cherry Red	5R - 5 - 8
Damaged	Milk Chocolate Brown	10RP -4 - 4

Dome Shadows

Our target area is characterized by the presence of many bare massive rock domes and spires. In our visual inspection of the ERTS 1 imagery, for damage from insects, we observed many images which resembled lakes but upon closer inspection they were determined to be dome shadows, since we knew from our ground truth data and existing maps the location of all of the lakes in our target area. We plan to so some further work on this problem through the use of various MSS bands, particularly band 7, to determine if these shadows show up on the various bands.

Significant Results

Through visual inspection of ERTS 1 imagery from the orbit of Sept. 16, 1972 of the Yosemite scene we can do the following. From the original 9 x 9 color infrared positive transparencies and color prints supplied by NASA from bands 4, 5, and 7, we can differentiate forests damaged by insects from those of little or no damage; and by using enlargements at a scale of 1 inch equals 1.5 nautical miles, we can differentiate and map three classes of forests damaged by insects into heavy, medium, and light with reasonable degree of certainty. We have also observed that shadows from massive rock domes are indistinguishable, visually, from natural lakes.

Future Work

Work for the coming two months period will be devoted to further refining our enlargement technique of ERTS 1 imagery to determine the maximum degree of enlargement without losing significant details and will concentrate on areas known to be heavily defoliated by the lodgepole needle miner.

(4)